

## LLNL List of Toxic, Corrosive, or Reactive Gases

Gases covered by this supplement	NFPA Standard 704 rating <sup>a</sup>		
	Health	Fire	Reactivity
Ammonia (anhydrous)	3	1	0
Arsine	4	4	2
Boron trichloride <sup>b</sup>	3	0	2
Boron trifluoride <sup>c</sup>	4	0	1
1,3 Butadiene <sup>d</sup>	2	4	2
Carbon monoxide <sup>e</sup>	2	4	0
Chlorine	4	0	0
Diborane	4	4	3
Dichlorosilane	4	4	2
Germane	4	4	3
Hydrogen bromide	3	0	0
Hydrogen chloride	3	0	1
Hydrogen cyanide	4	4	2
Hydrogen fluoride	4	0	2
Hydrogen selenide	4	4	3
Hydrogen sulfide	4	4	0
Nitric oxide	3	0	1
Nitrogen dioxide	4	0	0
Organoarsenic, organotin, organoindium, organogallium	<sup>f</sup>	<sup>f</sup>	<sup>f</sup>
Phosgene	4	0	1
Phosphine	4	4	2
Silane <sup>g</sup>	2	4	3
Vinyl chloride monomer <sup>d</sup>	2	4	1
Gases not covered			
Acetylene	1	4	3 <sup>h</sup>
Carbon monoxide (<35 ppm)	1	0	0
Hydrogen	0	4	0
Isobutane	1	4	0
Methane	1	4	0
Nitrogen trifluoride	1	0	0
Oxygen (gas)	0	0	0 <sup>h</sup>
Propane	1	4	0
Sulfur hexafluoride	1	0	0

<sup>a</sup> More complete definitions of NFPA ratings are given in Appendix A. Ratings for mixtures of gases in other gases, especially inert gases, may be lower. The ES&H Team will provide assistance in determining revised ratings for mixtures.

<sup>b</sup> Also applies to GeCl<sub>4</sub>, SiCl<sub>4</sub>, TiCl<sub>4</sub>, and other gases that form hydrochloric acid on contact with moisture.

<sup>c</sup> Also applies to AsF<sub>5</sub>, PF<sub>5</sub>, and WF<sub>6</sub> and other gases that form hydrofluoric acid on contact with moisture.

<sup>d</sup> A carcinogen with an HMIS health rating of 4 for long-term effects but only an NFPA rating of 2.

<sup>e</sup> Covered only by administrative controls and by the requirements in the "Cylinder Storage" and "PPE" sections of this document.

<sup>f</sup> Organometallic compounds often warrant an NFPA health rating of 3 or 4, or a 4 rating when long-term hazards are considered. These compounds are often handled like gases.

<sup>g</sup> Silane and its derivatives need special controls because they can ignite in air as soon a leak begins. They can also leak, accumulate, and later deflagrate (i.e., burn in a low-grade explosion that is still very destructive).

<sup>h</sup> See OSHA regulations 29 CFR 1910.253 for precautions for handling acetylene and oxygen gas in welding/brazing applications; the provisions of this supplement apply to research uses of acetylene.